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(54) IMPROVED WIND TURBINE SUITABLE FOR MOUNTING WITHOUT A WIND TURBINE TOWER

VERBESSERTE WINDTURBINE ZUR MONTAGE OHNE EINEN WINDTURBINENTURM

ÉOLIENNE AMÉLIORÉE ADAPTÉE À UN MONTAGE SANS MÂT D'ÉOLIENNE

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Description

TECHNICAL FIELD

[0001] 0001. This patent relates to wind turbines that increase air flow through the use of nozzles and diffusers and that are suitable for mounting without a wind turbine tower.

BACKGROUND

[0002] **0002.** Wind turbines are well known as means of converting the kinetic energy of the wind into mechanical energy by the turning of rotor blades. In turn, the mechanical energy can then be converted into electrical energy by means of an electrical generator.

[0003] **0003.** One type of a wind turbine used for electricity generation is comprised of a rotor with a multiplicity of long slender blades connected to a common spindle situated on the top of a suitably sized tower. An illustration of this type can be found in Figure 1 of US8,622,698. Challenges faced in practice with this type of wind turbine are inefficiency at low wind speeds, the height of the towers and blades - required for safety and efficiency - and the overall intrusive appearance of such large structures. US8,622,698 also illustrates the common wind turbine tower used in practice: a slender, tall single element support.

[0004] **0004.** In part, the efficiency of a wind turbine is predicted by Betz's Law. This law predicts that a wind turbine can only capture less than 16/27 (59.3%) of the kinetic energy of the wind. The limit arises as a result of the collision of air molecules that transfer their energy to the rotor blades.

[0005] 0005. In practice, wind turbines can only capture about 75 to 80% of the Betz's Law limit. However, a means of achieving higher efficiencies is to collect additional wind flow by the use of nozzles and diffusers before and after the rotor. The challenge is more fully described in US20120175882

[0006] 0006. Many wind turbines with shrouds or cowlings to create nozzles and diffusers are known in the art. One example is found at WO2012137008. Other examples are found in US2006/0002786A1, CN2835635Y and WO2006065248. An earlier type of wind turbine shroud specified for use on a tower structure is found at US4075500. However, in practice, the weight and wind load of the shrouds prove to be difficult to mount on wind turbine towers.

[0007] 0007. Other short-comings of wind turbines are found at paragraph 0014 and following of US2012282092. These include: inefficient operation close to the ground; large dimensions required by towers; expensive maintenance and cyclic stresses and failures.

[0008] 0008. One type of inefficiency in wind turbines is created by the wind currents which are created at the tips of blades. One means of solving this problem is to enclose the blades in a structure whereby there are no such currents. Such an arrangement is found in CA2590918 (at Figure 3). In this patent, the drum also acts as a part of the electrical generator.

[0009] **0009.** It would be beneficial if a wind turbine could be designed that would be efficient at lower wind speeds, could be installed without the use of the common wind turbine tower and could generally overcome the previously known short-comings of wind turbines in general. CA2590918 previously referred to teaches that a cowled turbine can be installed at the top of a wind turbine tower. CA25090918 also teaches the use of a fin to passively steer the turbine into the wind.

[0010] **0010.** US4140433 teaches the elimination of the wind turbine mast. However, similar to CA2590918, US4140433 teaches only the use of a freely-rotatable turntable to ensure the turbine turns into the wind and the additional use of tail fins (Column 9, line 5) to ensure that the turbine self-centers in the wind.

[0011] **0011.** Another short-coming of turbine design is the use of a single generator operating coaxially with or driven by the central shaft of the rotor of the turbine. Such a placement requires that the turbine be shut down for generator maintenance or repair. In addition, placement of the generator at the central shaft of the rotor generally involves difficult access in tight quarters. CA2590918 previously referred to, teaches the optional use of one generator driven by the circumference of the rotor (Figure 5) but does not teach the use of a mechanical interruption or the use of more than one generator.

[0012] **0012.** The use of only one generator in wind turbines limits their ability to efficiently generate electricity over a wide range of wind speeds. A generator sized for average expected wind speeds is generally inefficient at lower air speeds causing the wind turbine to be idled in such conditions.

[0013] 0013. A challenge with electricity generation is the losses of electricity in the transmission and distribution system. Significant amounts of electricity are lost in the simple transmission of electricity from one place to another. Because of this challenge, it is desirable that generation systems be placed close to where electricity will be used. The present invention allows generation capacity to be placed in close proximity to or, in suitable cases, on, buildings eliminating transmission losses.

[0014] 0014. A final challenge with systems related to electricity is the difficulty in storing excess electricity and smoothing out fluctuations in the electricity source. This challenge is pronounced when using wind to power electricity generators due to natural fluctuations in the wind. One means of solving this problem is by the use of flywheels and clutches as found in US8749083. However, the system proposed therein suffers the challenge of having to mount a heavy flywheel at the top of a wind turbine tower.

[0015] 0015. Liquids such as water may have flows similar to gasses such as air. A short-coming of the designs of most wind turbines is the inability to adapt those designs to areas of natural water flow in order to generate

electricity.

[0016] 0016. Another shortcoming of most wind turbine designs is the lack of interoperability with other forms of motive force.

SUMMARY OF THE INVENTION

[0017] 0017. It is an object of this invention to overcome limitations of the prior art in increasing the wind speed through the device.

[0018] 0018. It is another object of this invention to improve the efficiency of electricity generation by providing for a connection between the rotor and one or more of a plurality of electrical generators on the circumference of the rotor as appropriate for the velocity through the rotor.

[0019] **0019.** It is another object of this invention to create a means of storing excess electricity by mechanical or other means and to allow such excess capacity to be used as required.

[0020] **0020.** It is another object of this invention to create a compact device which may be easily mounted horizontally or vertically and used in any location including on the roofs of buildings.

[0021] **0021.** It is another object of this invention to interoperate with other forms of motive force on the same installation.

[0022] **0022.** It is another object of this invention to enable the use of one or more devices according to the present invention in the same installation.

[0023] **0023.** This patent describes a device according to claim 1 which, in one embodiment, uses a central drum-style rotor in which the wind-driven blades are affixed. The use of a drum-style rotor allows the blades to be fixed on the outside or circumference of their motion eliminating the vortices that develop in more conventional wind turbines.

[0024] **0024.** The use of a drum-style rotor also allows many different types and dispositions of blades to be used. The two principle types of blades that can be used are screw and fan blades.

[0025] 0025. A screw blade is a helical flange with the width of the flange being roughly equal to the radius of the rotor. The flange is connected on its outside end to the rotor following the path of a helix. The central side of the flange can be loose or optionally connected to a spindle co-axial with the rotor. If more than one screw blade is used, the screw blades are proportionally located within and co-axial with the rotor. In the event of an even number of flanges opposite sided-flanges will trace out a helicoid shape with opposite flanges actually being one piece.

[0026] 0026. The helix of the screw blade can be right- or left-handed and will have a pitch described as the distance between the points where the helix has made one complete turn. In addition, the flange can be connected to the rotor at various angles. The handedness, the pitch, the rotor-connection angle and the position within the rotor of the screw blade may be determined by experimentation and optimized for a particular combination of rotor sizes and wind speeds.

[0027] 0027. A fan blade is a plurality of blades about a central axis co-axial with the rotor. The blades are connected at their distal ends with the rotor and at their central ends with each other or with an optional spindle. The shape, sizes, angles and design of the fan blades and their location within the rotor may be determined by experimentation and optimized for a particular combination of rotor sizes and wind speeds.

[0028] **0028.** Other types of rotors can be used in the present invention. For example, a central spindle can be provided for to which appropriately sized fans or blades are affixed. Appropriate hubs can be affixed to the central spindle as required.

[0029] **0029.** Nozzles to concentrate the wind can be placed before the rotor to increase the flow of incoming air. In similar fashion, diffusers can be placed behind the rotor in order to drop the pressure of the exiting air. Both techniques are useful in order to increase the ability of the device to generate electricity in low wind velocity situations.

[0030] 0030. Nozzles and diffusers can be fashioned through the use of appropriately shaped cowlings. Intake cowlings concentrate wind to create a nozzle for intake airflow. Exit cowlings create low pressure zones to act as diffusers for output airflow.

[0031] **0031.** Another means of increasing the wind velocity on the rotor is to use a reverse conical spindle. Such a spindle will increase the venturi effect present within the rotor. The actual location of such a spindle would take the disposition of the blades to be used into account as well as any nozzle or diffuser being used.

[0032] 0032. The rotor rotates freely about its axis. Such a free rotation can be accomplished with traditional bearing rings at two or more places around the rotor. Alternately, less friction-prone bearing systems such as air bearings or magnetic bearings can be used and are well known in the art.

[0033] **0033.** The device can be turned by a suitably-sized motor driven turntable which is well known in the art. Anemometers to measure direction and speed of wind and control circuitry well known in the art are used to determine the direction required. Unlike traditional turntables used with wind turbines, which rotate freely and may be directed into the wind using passive methods such as fins, this allows the device to be turned both into and away from the wind through controlled means as required by prevailing wind conditions.

[0034] 0034. The drum-style rotor of the present invention presents a number of different means by which electrical generators can be mechanically connected. A plurality of generators is used with mechanical means to individually connect each generator to the circumference of the rotor. Because the mechanical connection of a generator creates a load for the rotor, in low wind situations, it is desirable to only have one or more generators mechanically connected with the rotor to operate at the

generator's highest efficiency given the lower wind speed. At high wind loads, more generators can be mechanically connected to the circumference of the rotor to take advantage of the higher energy present in the system. Means to mechanically interrupt the connection of generators with the rotor and to control the same are well known in the art.

[0035] 0035. In addition to one or more electrical generators, the present invention can use such electrical generators in reverse as drivers. The said drivers can use electrical energy to rotate the rotor to bring it up to operational speeds when first activated. Alternately, drivers can be used to store surplus electrical energy in the rotor or in the co-axial flywheel.

[0036] 0036. In the present invention the generators which are connected to the circumference of the rotor can be easily serviced or maintained without stopping the entire device. The generator to be serviced or maintained can be disconnected from the circumference of the rotor and then easily removed by an overhead crane as required.

[0037] 0037. The device has a co-axial flywheel with the rotor. The flywheel can be connected to the rotor and generators with clutches and gearing in order to store the motion of the rotor in the flywheel or alternately to have the flywheel power the generators. It is also possible, at times of electrical energy surplus, to operate the system in reverse by having the generators act as drivers which in turn transfer energy to the flywheel.

[0038] 0038. The means to connect and transfer the motion of the flywheel to and from the rotor and generators and to control the same are well known in the art and include one and two-way clutches, gearboxes and torque converters.

[0039] 0039. The device as described can be mounted without a tower. The overall size of the device is proportional to the diameter of the rotor and the additional cowling.

[0040] 0040. The device is disposed in a modular fashion allowing multiple units to be used in a common installation on a common turntable rotation system. In a modular installation with multiple units, any one or more units may be easily removed for repair or maintenance, by means of an overhead crane and in any weather conditions, while leaving the balance of the units in place for production.

[0041] **0041.** Although the device is inherently robust, in the event of very high wind speeds such as during tropical storms and hurricanes, the controller can angle the device partially or fully into or away from the wind by means of the motor driven turntable, in order to continue operating under these conditions and capture the maximum power of the device. Existing designs must be shut down in these conditions.

[0042] **0042.** Another object of the invention is to use and store surplus energy from alternate energy sources such as steam, gas or any other motive force.

[0043] **0043.** The present invention can also be adapted for use in natural water-courses. All of the internal aspects can be waterproofed with the rotor turned into or placed within the direction of water flow.

[0044] **0044.** As part of an overall system of such turbines, it is an object of the present invention to be used and mounted in a wide range of locations and installations. For example, in a coastal area, the device as a wind turbine could be mounted on off-shore towers or barges and in on-shore installations including towers and buildings of different heights. The device can also be effectively used in the water where the possibility of a driving current exists.

BRIEF DESCRIPTION OF THE DRAWINGS

[0045] **0045.** Embodiments of the present invention are explained, by way of example, and with reference to the accompanying drawings. The drawings illustrate only examples of embodiments of this invention and are therefore not to be considered limiting of its scope, as the invention may have other equally effective embodiments.

0046. Figure 1 illustrates a cut-away perspective view of a wind turbine according to the invention.

0047. Figure 2 illustrates a front-view of a wind turbine according to the invention.

0048. Figure 3 illustrates a cross-sectional view of a wind turbine according to the invention across a section A-A from Figure 2.

0049. Figure 4 illustrates a phantom view of the principal interior components of a wind turbine according to the invention in the same orientation as figure 3.

0050. Figure 5 illustrates a phantom view of a wind turbine according to the invention as in figure 4 with an alternate outer housing and situated on a turntable.

0051. Figure 6 illustrates a perspective view of a wind turbine according to the invention as illustrated in figure 5.

0052. Figure 7 illustrates a front view of a wind turbine according to the invention as illustrated in figure 5.

0053. Figure 8 illustrates a detailed schematic view of a generator assembly used in a wind turbine according to the invention.

0054. Figure 9 illustrates a rear view of a wind turbine according to the invention as illustrated in any of the foregoing figures with the exit cowling removed in order to illustrate the disposition of the interior workings.

0055. Figure 10 illustrates a side phantom view of an alternate embodiment of the invention where multiple wind turbines are grouped together in a common housing with overhead crane for maintenance.

0056. Figure 11 illustrates a perspective view of the alternate embodiment of the invention of figure 10.

0057. Figure 12 illustrates a front view of the alternate embodiment of the invention of figure 10.

0058. Figure 13 illustrates a perspective view of another alternate embodiment of the invention where a different grouping of multiple wind turbines are grouped together in a common housing.

0059. Figure 14 illustrates a front view of the alternate embodiment of the invention of figure 13.

0060. Figure 15 illustrates a side phantom view of the alternate embodiment of the invention of figure 13 showing that wind turbines can also be grouped in a disposition where the outlet ports of one set of wind-turbines can feed the intake ports of additional wind-turbines all within a common housing.

0061. Figure 16 illustrates the wind-turbine of figures 10, 11 and 12 situated on top of the roof of a building.

0062. Figure 17 illustrates the invention of figures 10, 11 and 12 situated in many types of land based installations.

0063. Figure 18 illustrates the invention of figures 10, 11 and 12 situated in off shore based installations.

0064. Figure 19 is a schematic of a portion of the invention used in light wind conditions

0065. Figure 20 is a schematic of a portion of the invention used in medium wind conditions

0066. Figure 21 is a schematic of a portion of the invention used in high wind conditions

0067. Figure 22 is a schematic of a portion of the invention being used in no wind conditions.

DETAILED DESCRIPTION

[0046] 0068. Figure 1 shows a cut-away perspective view of the wind turbine 10 according to the invention. The invention has helical blades 20 around a co-axial spindle 25. The housing 30 also shows the intake cowling 35 which concentrates the intake airflow as a nozzle. The cut-away section shows the location of the helical blade support 38 and a co-axial flywheel 40. Everything within the helical blade support 38 comprises the rotor of the invention.

[0047] 0069. Figure 2 shows a front view of the wind turbine 10 according to the invention. The turbine shows the leading edges 22 of the helical blades 20 around a co-axial spindle 25. The intake cowling 35 concentrates the intake airflow as a nozzle and covers other equipment within the wind-turbine preventing the entry of dirt, animals and other detritus which would interfere with the wind-turbine.

[0048] 0070. Figure 3 shows a cross-sectional view of the wind-turbine 10 across the section A-A from Figure 2. The wind turbine is turned so that the wind enters the wind turbine from the left and exits at the right. This shows the intake cowling 35 which concentrates the intake airflow as a nozzle, the helical blades 20 and the location of the co-axial flywheel 40. The figure also shows a co-axial spindle 25 designed to provide additional intake airflow concentration by being conical in shape with its largest end in the direction of the helical blades. The helical blades 20 rotate within the blade housing 41 which is, in turn separated from the outer housing 42 by suitably positioned guide rollers 44 or generator assemblies 50. Everything within the blade housing 41 acts as the rotor of the invention.

[0049] 0071. Figure 4 shows a phantom view of the principal interior components of the wind turbine 10 in the same orientation as figure 3. All parts within the outer housing 42 are shown with dashed lines. The intake cowling 35 together with a co-axial spindle 25 concentrate the incoming airflow as a nozzle. The co-axial spindle 25 in this embodiment is also designed to have an exit portion 26 which decreases the air pressure acting as a diffuser from the point of the leading edges 22 of the helical blades 20 to their trailing edges 23. The helical blades 20 are attached to the exit portion 26 of the co-axial spindle 25 and, on their other side, the blade housing 41. The blade housing 41 acting as the rotor of the invention rotates by suitably positioned guide rollers 44 or generator assemblies 50. The blade housing 41 may also be mechanically engaged with a gearbox 60 which allows mechanical energy from the blade housing 41 to the flywheel 40 which is co-axial with and external to the blade housing 41 but within the outer housing 42 and separated from the outer housing 42 with friction reducing means.

[0050] 0072. Figure 5 is a phantom view of the principal interior components of a different embodiment of the invention. All parts within the alternate outer housing 43 are shown with dashed lines. The alternate embodiment of the invention is the wind turbine 10 with an alternate outer housing 43 which includes an extended intake cowling 46 and extended exit cowling 47. The wind turbine is turned on a mechanical turntable 70 so that the wind enters the wind turbine from the left and exits at the right. The mechanical turntable 70 can be powered by motors or other means and controlled by microcontrollers with input signals from vane anemometers and other techniques well known by those skilled in the art. The turntable 70 rotates about the centre line 71. The extended intake cowling 46 provides additional cross-sectional area to capture greater wind energy and acts as a nozzle. The extended exit cowling 47 lowers the pressure of the output airflow, increasing the speed of the air through the wind-turbine and acting as a diffuser.

[0051] 0073. Figure 6 shows the device of Figure 5 in perspective view. Also shown is an optional mesh 75 placed at the entrance of the device and sized to prevent the entry of unwanted animals and objects and to act as a safety mechanism. This figure shows the wind turbine 10 which can be turned on a mechanical turntable 70 in order to place the opening into the wind. Also shown are the extended intake cowling 46 and the extended exit cowling 47. Inside the mesh can also be seen the co-axial spindle 25, the intake cowling 35, and the leading edges 22 of the helical blades 20.

[0052] 0074. Figure 7 shows the device of Figure 6 in frontal view. This figure shows the extended intake cowling 46. The co-axial spindle 25, the intake cowling 35,

and the helical blades 20 can also be seen. Also shown is the mechanical turntable 70.

[0053] 0075. Figure 8 shows a schematic detail of a generator assembly. A generator or alternator 80 is mounted on a hinged base 84 and is directly connected to a friction wheel or gear 82. The friction wheel or gear 82 can be engaged with a suitable driving source by engaging the actuator 86 which allows the friction wheel or gear 82 to be engaged with a source of rotational energy. The output of the generator or alternator 80 are connected by means well known in the art to enable the production of electricity by engaging the generator assembly with the rotor of the invention.

[0054] 0076. Figure 9 shows a full rear view of the wind turbine 10 with the exit cowling removed. This figure shows the trailing edges 23 of the helical blades 20 within the blade housing 41 which are, in turn, supported by the guide rollers 44. All of the details within the blade housing 41 act as the rotor of the invention. Generator assemblies 50 can be engaged with the blade housing 41 acting as the rotor on an individual basis in accordance with a controller system which is well known by those who are skilled in the art. The said controller system would allow the engagement of generator assemblies with the blade housing 41 in proportion to the wind available.

[0055] 0077. Figure 10 shows an alternate embodiment of the invention where individual wind turbine units can be grouped together in order to maximize wind energy available at specific locations. Each individual windturbine unit 11 can be housed in an external housing 90 which has an extended intake cowling 91 disposed to concentrate wind energy available to all units in the grouping. An overhead crane 93 can be used for maintenance and removal of individual units. The overall assembly is located on an appropriately sized mechanical turntable 70.

[0056] 0078. Figure 11 shows a perspective view of the alternate embodiment of a grouping of individual wind turbine units illustrated in figure 10.

[0057] 0079. Figure 12 shows a frontal view of the alternate embodiment of a grouping of individual wind turbine units illustrated in figure 10.

[0058] 0080. Figure 13 shows a perspective view of an alternate embodiment of the invention where multiple wind turbine units according to the invention are grouped together in an alternate external housing 92.

[0059] 0081. Figure 14 is a frontal view of the alternate embodiment of the invention shown in figure 13.

[0060] 0082. Figure 15 is a side phantom view of the alternate embodiment of the invention shown in figure 13 where the dashed lines represent the principal components of the invention within the external housing. The figure illustrates that a second set of wind turbine units 95 can be placed behind a first set of wind turbine units 96 in order to ensure all wind energy available is converted within the invention. The space 97 between the two sets of wind turbine units is shaped and provided in a fashion that maximizes the diffuser effects for the first set of wind turbine units 96 and the nozzle effects for the second set of wind turbine units 95.

[0061] 0083. Figure 16 shows the embodiments of the invention illustrated in figures 10, 11 and 12, located on a building 100. The building is not shown as part of the invention but only to illustrate the present invention can be easily located on the top of a building with suitable mechanical connection and control means well known to those skilled in the art.

[0062] 0084. Figure 17 shows embodiments of the invention illustrated in figures 10, 11 and 12 located on different structures in land based applications. The installations shown are specifically a vertical installation and a run of river installation. The structures are not shown as part of the invention but only to illustrate how the present can be easily located on various structures. Wind turbines 10 can be located on towers or buildings. Groupings of turbines 15 as in any of figures 10 to 15 can also be mounted on buildings of different heights. Turbines 16 powered from water currents can also be installed.

[0063] 0085. Figure 18 shows embodiments of the invention illustrated in figures 10, 11 and 12 located on different structures in an off shore based installation. The structures are not shown as part of the invention but only to illustrate how the present can be easily located on various structures. Wind turbines 10, or grouping of turbines 15 as in any of the figures 10 to 15, can be located on off-shore towers or barges. Turbines 16 powered from water currents can also be installed.

[0064] 0086. Figure 19 shows a schematic of a portion of the invention being used in light wind conditions. One or more of the generators 50 are placed in mechanical connection with the blade housing 41 to generate electricity. The cross-hatched areas show those portions of the invention being powered.

[0065] 0087. Figure 20 shows a schematic of a portion of the invention being used in medium wind conditions. One or more generators 50 are placed in mechanical connection with the blade housing 41 to generate electricity. In addition, the co-axial flywheel 40 is also connected with the blade housing 41 to spin up the flywheel. The cross-hatched areas show those portions of the invention being powered.

[0066] 0088. Figure 21 shows a schematic of a portion of the invention being used in high wind conditions. One or more generators 50 are placed in mechanical connection with blade housing 41 to generate electricity. In addition, the co-axial flywheel 40 is connected with the blade housing 41 to store surplus energy from the rotor which is not required by the generators. The cross-hatched areas show those portions of the invention being powered.

[0067] 0089. Figure 22 shows a schematic of a portion of the invention being used in no wind conditions. Rotational energy in the flywheel 40 and the blade housing 41 are used to connect with one or more generators 50 to generate electric energy. The cross-hatched areas show those portions of the invention being powered. The

flywheel 40 is co-axial with the drum style rotor and is located within the housing which can be interruptibly connected through two-way clutching means with either the said drum style rotor or with one or more of the plurality of generators 50 or other motive force 150 in order to store or use rotational energy.

Claims

1. A modular wind turbine (10) comprising:

- a housing (30, 42, 43) comprising a flat base, an open housing inlet end and an open and opposite housing exit end wherein the said housing is shaped to allow a plurality of the said housings to be used in a stacked modular fashion;
- a freely rotatable drum style rotor (25, 20, 38, 41) horizontally mounted within the said housing (30, 42, 43) and the said drum style rotor is open at both ends with a rotor inlet end for funneling air into the rotor and a rotor exit end opposite the said rotor inlet end to direct air away from the drum style rotor, and wherein the said rotor inlet end and said rotor exit end are aligned with the said housing inlet end and said housing exit end respectively;
- one or more blades (20) disposed within and connected to the said drum style rotor and coaxial therewith whereby the passage of air through the said drum style rotor induces the said drum style rotor to rotate about its axis;
- an inlet cowling (35) within the said housing (30) and located at the said housing inlet end to concentrate air as a nozzle and direct the said concentrated air into the said drum style rotor;
- a plurality of generators (50) which are interruptibly connected with the said drum style rotor and located on the periphery of the said drum style rotor within the said housing (30, 42, 43) in order to generate electricity;
- a flywheel (40) co-axial with the said drum style rotor and located within the said housing (30, 42, 43) which can be interruptibly connected through two-way clutching means with either the said drum style rotor or one or more of the said plurality of generators (50) or other motive force (150) in order to store or use rotational energy;
- a motor driven turntable (70) on which the said flat base of the said housing (30, 42, 43) rests or is attached and which allows the wind turbine to be directed into the wind;
- a controller which measures speed and direction of the wind and controls the said motor driven turntable, and the said interruptible connections between the said drum style rotor and the said plurality of generators (50) or other motive force (150), and the said interruptible connection between the said drum style rotor and the said flywheel (40) in order to maximize the electrical output of the said wind turbine under different operating conditions.

2. A modular wind turbine according to claim 1, comprising an exit cowling (47) within the said housing and located at the said housing exit end configured to act as a diffuser receiving the exit air from the said rotor.

Patentansprüche

1. Modulare Windturbine (10), die Folgendes umfasst:

- ein Gehäuse (30, 42, 43), das eine flache Basis, ein offenes Gehäuseeinlassende und ein offenes und gegenüberliegendes Gehäuseausgangsende umfasst, wobei das Gehäuse dazu geformt ist, einer Vielzahl von den Gehäusen zu ermöglichen, in einer gestapelten modularen Weise verwendet zu werden;
- einen frei drehbaren Trommelrotor (25, 20, 38, 41), der innerhalb des Gehäuses (30, 42, 43) horizontal montiert ist und wobei der Trommelrotor an beiden Enden offen ist, mit einem Rotoreinlassende zum Schleusen von Luft in den Rotor und einem Rotorausgangsende gegenüber dem Rotoreinlassende zum Leiten von Luft weg von dem Trommelrotor, wobei das Rotoreinlassende und das Rotorausgangsende jeweils mit dem Gehäuseeinlassende und dem Gehäuseausgangsende ausgerichtet sind;
- eine oder mehrere Laufschaufeln (20), die innerhalb des Trommelrotors angeordnet und mit diesem verbunden und damit koaxial sind, wobei das Durchlaufen von Luft durch den Trommelrotor den Trommelrotor dazu veranlasst, sich um seine Achse zu drehen;
- eine Einlassverkleidung (35) innerhalb des Gehäuses (30) und an dem Gehäuseeinlassende dazu positioniert, als eine Düse Luft zu konzentrieren und die konzentrierte Luft in den Trommelrotor zu leiten;
- eine Vielzahl von Generatoren (50), welche mit dem Trommelrotor unterbrechbar verbunden und auf dem Umfang des Trommelrotors innerhalb des Gehäuses (30, 42, 43) positioniert sind, um Elektrizität zu erzeugen;
- ein Schwungrad (40), das mit dem Trommelrotor koaxial ist und innerhalb des Gehäuses (30, 42, 43) positioniert ist, welches durch bidirektionale Kupplungsmittel entweder mit dem Trommelrotor oder einem oder mehreren der Vielzahl von Generatoren (50) oder einer anderen Antriebskraft (150) unterbrechbar verbunden werden kann, um Rotationsenergie zu ver-

wenden oder zu speichern;
- einen motorgetriebenen Drehteller (70), auf welchem die flache Basis des Gehäuses (30, 42, 43) ruht oder angebracht ist, und welcher der Windturbine ermöglicht, in den Wind gerichtet zu werden;
- eine Steuerung, die eine Geschwindigkeit und eine Richtung des Winds misst und den motorgetriebenen Drehteller und die unterbrechbaren Verbindungen zwischen dem Trommelrotor und der Vielzahl von Generatoren (50) oder einer anderen Antriebskraft (150) und die unterbrechbare Verbindung zwischen dem Trommelrotor und dem Schwungrad (40) steuert, um die elektrische Ausgabeleistung der Windturbine unter verschiedenen Betriebsbedingungen zu maximieren.

2. Modulare Windturbine nach Anspruch 1, umfassend eine Ausgangsverkleidung (47), die innerhalb des Gehäuses und an dem Gehäuseausgang positioniert und dazu konfiguriert ist, als ein Diffusor zur wirken, der die Ausgangsluft von dem Rotor empfängt.

Revendications

1. Éolienne modulaire (10), comprenant :

- un boîtier (30, 42, 43) comprenant une base plane, une entrée de boîtier ouverte et une sortie de boîtier ouverte et opposée dans laquelle ledit boîtier est façonné pour permettre à une pluralité desdits boîtiers d'être utilisés d'une manière modulaire empilée ;
- un rotor de type Savonius à rotation libre (25, 20, 38, 41) monté horizontalement à l'intérieur dudit boîtier (30, 42, 43) et ledit rotor de type Savonius est ouvert aux deux extrémités avec une extrémité d'entrée de rotor pour canaliser de l'air à l'intérieur du rotor et une extrémité de sortie de rotor opposée à ladite extrémité d'entrée de rotor pour canaliser l'air à l'écart du rotor de type Savonius, et dans laquelle ladite extrémité d'entrée de rotor et ladite extrémité de sortie de rotor sont alignées avec ladite extrémité d'entrée de boîtier et ladite extrémité de sortie de boîtier respectivement ;
- une ou plusieurs aubes (20) disposées à l'intérieur de et reliées audit rotor de type Savonius et coaxiales avec celui-ci moyennant quoi le passage d'air à travers ledit rotor de type Savonius induit la rotation dudit rotor de type Savonius autour de son axe ;
- un carénage d'entrée (35) à l'intérieur dudit boîtier (30) et situé au niveau de ladite extrémité d'entrée de boîtier pour concentrer de l'air comme une buse et diriger ledit air concentré à l'intérieur dudit rotor de type Savonius ;
- une pluralité de génératrices (50) qui sont reliées de manière interruptible audit rotor de type Savonius et situées sur la périphérie dudit rotor de type Savonius à l'intérieur dudit boîtier (30, 42, 43) afin de générer de l'électricité ;
- un volant d'inertie (40) coaxial avec ledit rotor de type Savonius et situé à l'intérieur dudit boîtier (30, 42, 43), qui peut être relié de manière interruptible par l'intermédiaire de moyens d'embrayage bidirectionnel avec le rotor de type Savonius ou bien une ou plusieurs de ladite pluralité de génératrices (50) ou bien une autre force motrice (150) afin de stocker ou utiliser une énergie de rotation ;
- une plaque tournante entraînée par moteur (70) sur laquelle ladite base plane dudit boîtier (30, 42, 43) repose ou est fixée et qui permet à l'éolienne d'être dirigée dans le vent ;
- un dispositif de commande qui mesure la vitesse et la direction du vent et commande ladite plaque tournante entraînée par moteur et lesdites liaisons interruptibles entre ledit rotor de type Savonius et ladite pluralité de génératrices (50) ou autre force motrice (150), et ladite liaison interruptible entre ledit rotor de type Savonius et ledit volant d'inertie (40) afin de maximiser le rendement électrique de ladite éolienne sous différentes conditions de fonctionnement.

2. Éolienne modulaire selon la revendication 1, comprenant un carénage de sortie (47) à l'intérieur dudit boîtier et situé au niveau de ladite extrémité de sortie de boîtier configuré pour agir en tant qu'un diffuseur recevant l'air de sortie en provenance dudit rotor.

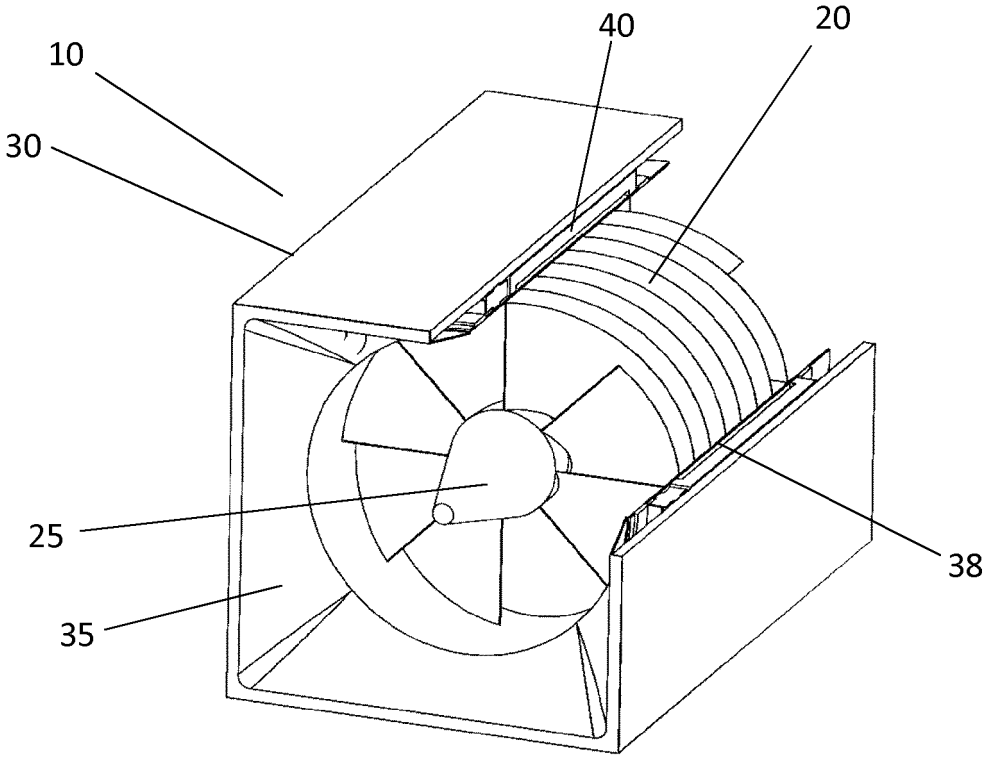


Figure 1

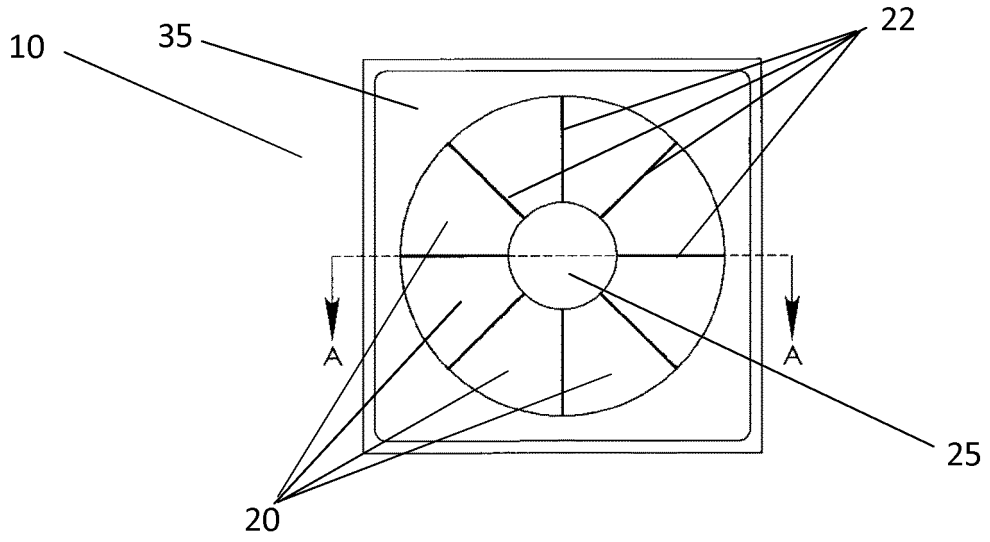
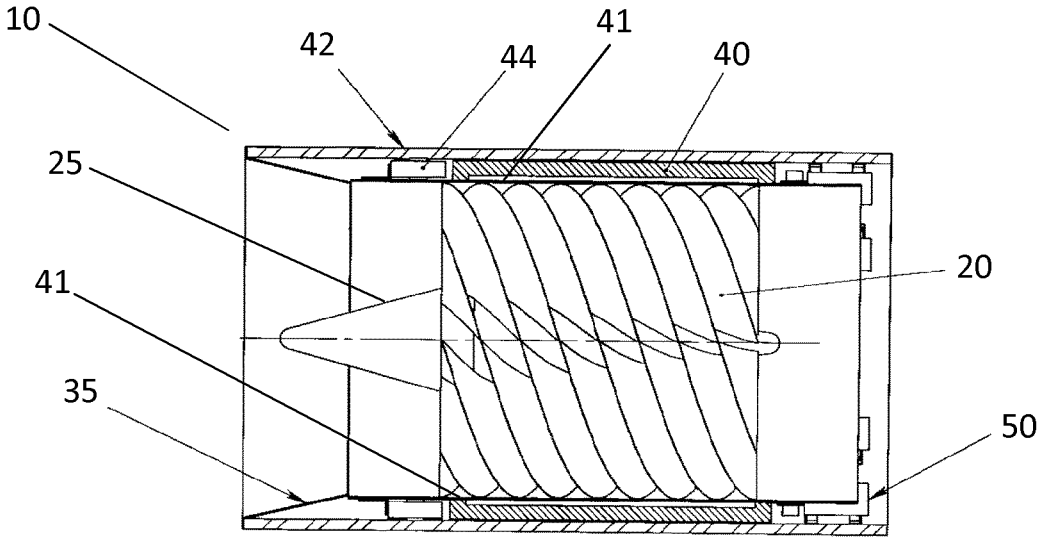


Figure 2



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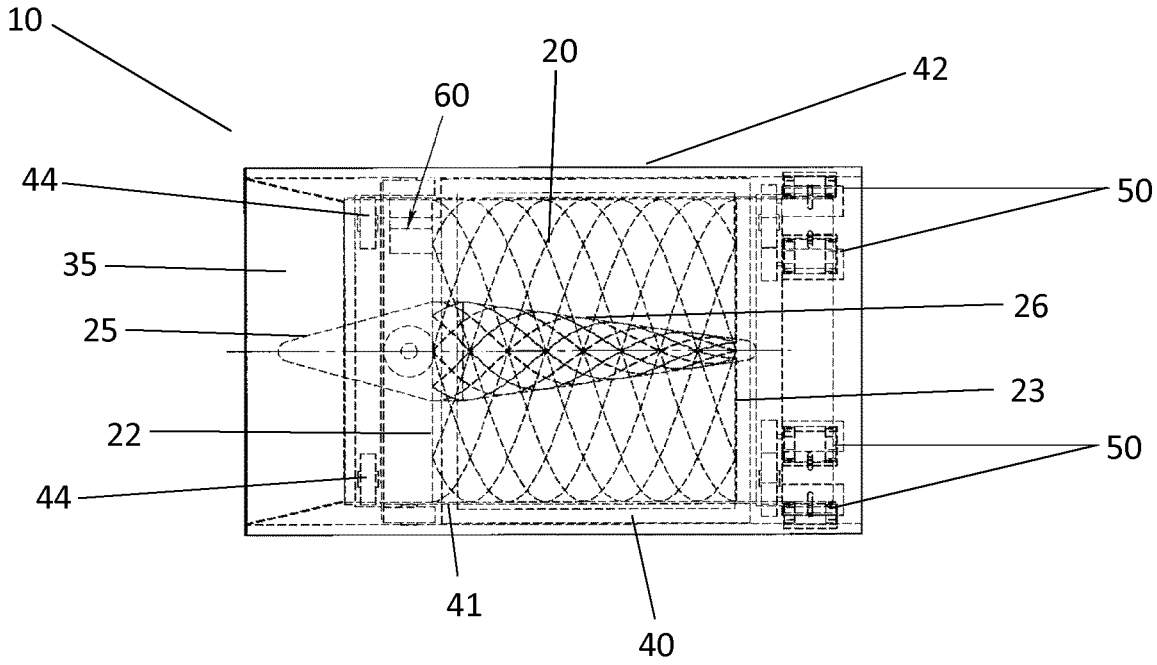

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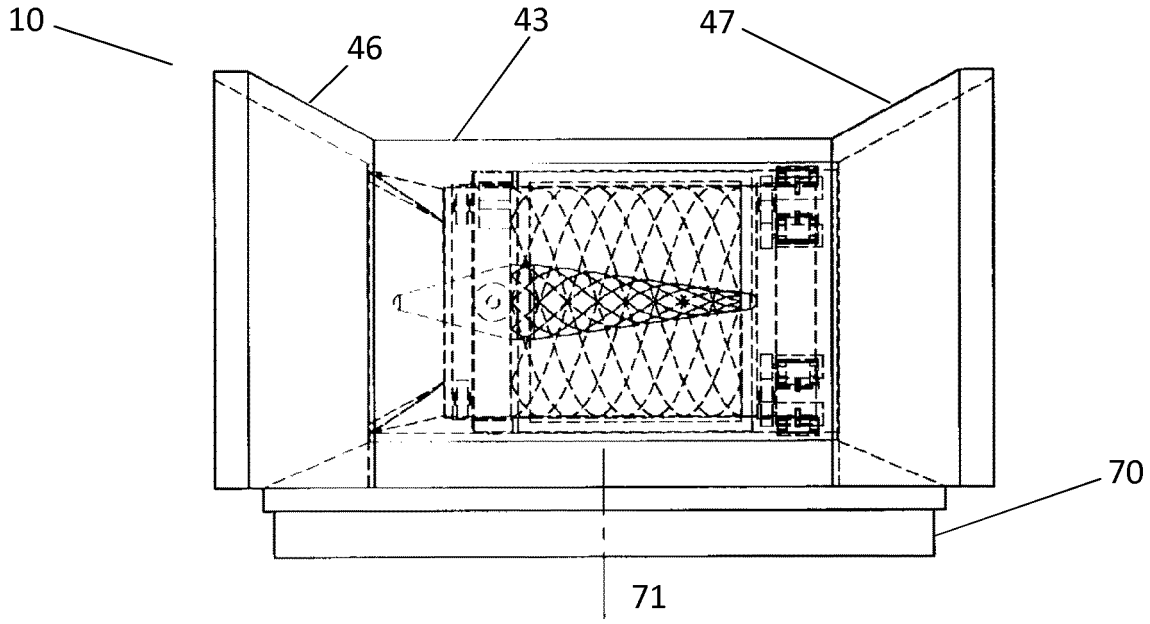

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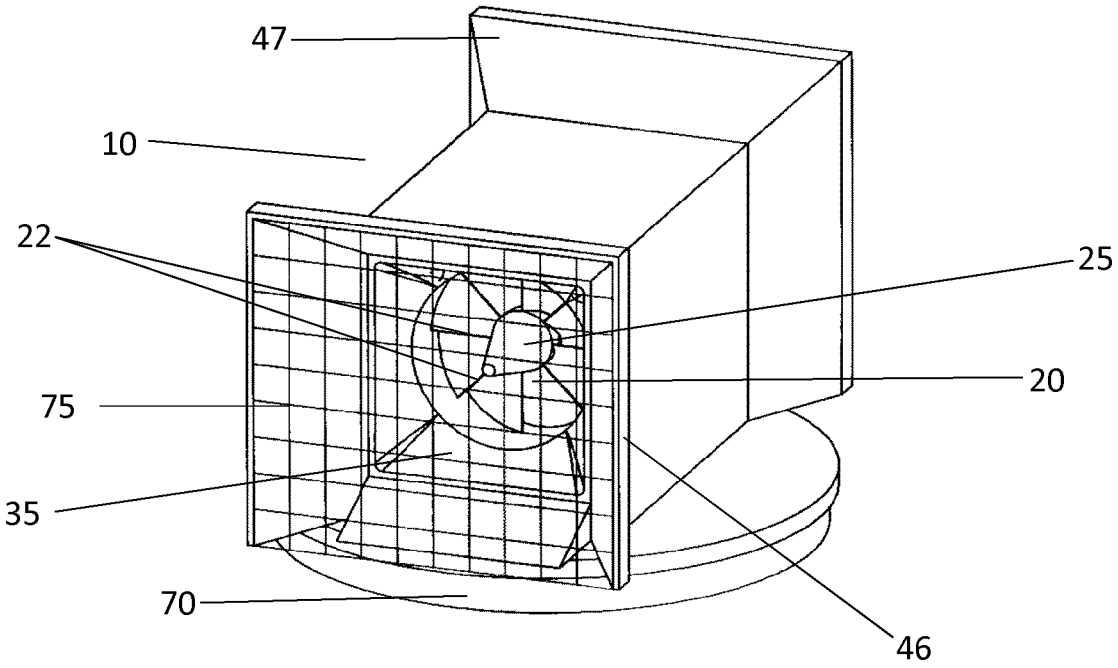

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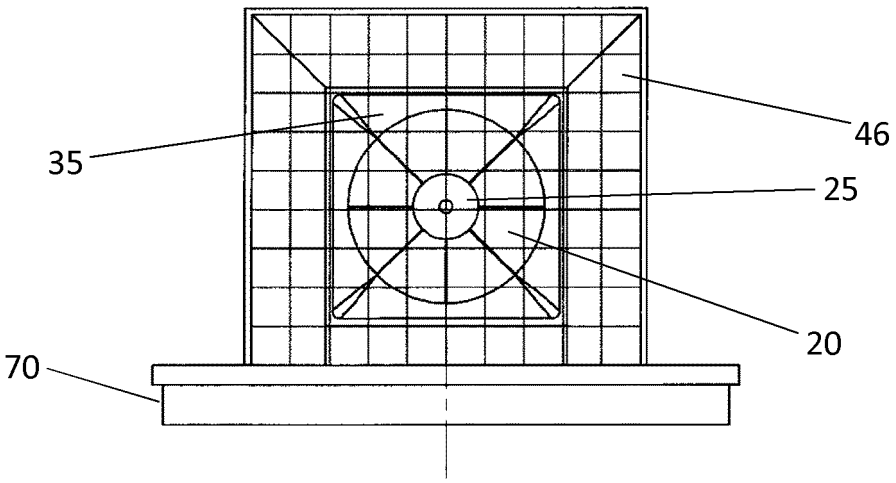

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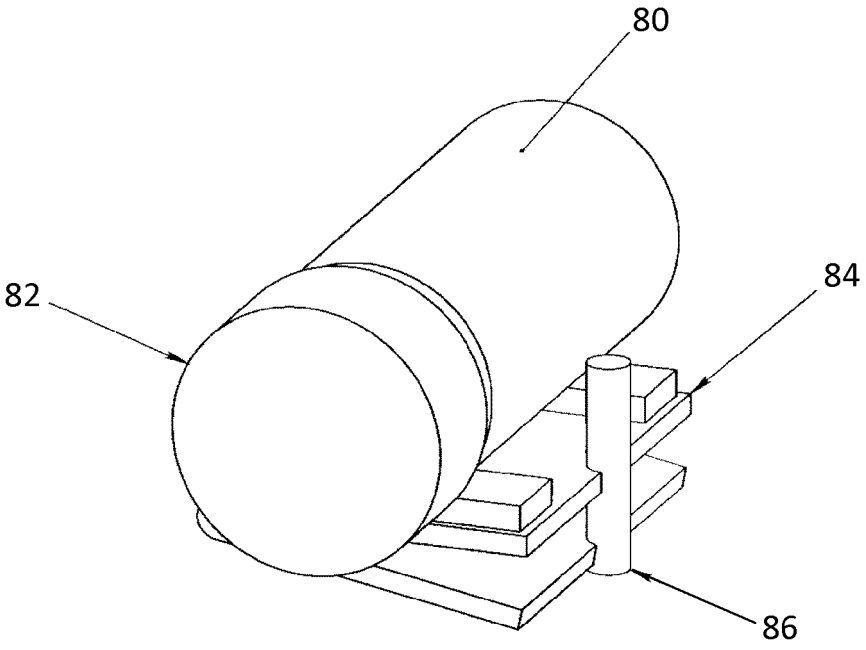

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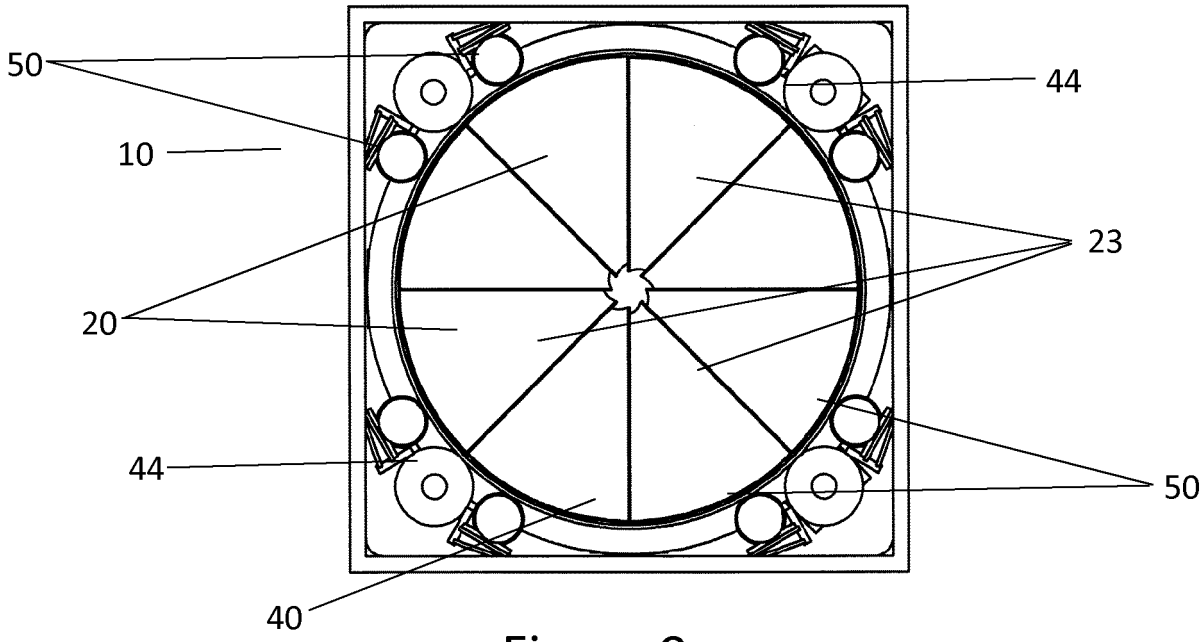

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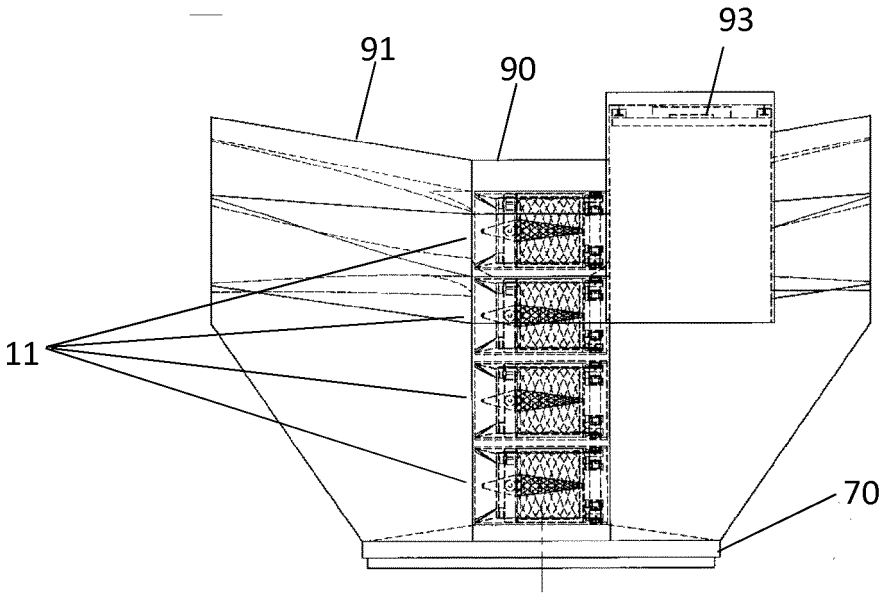

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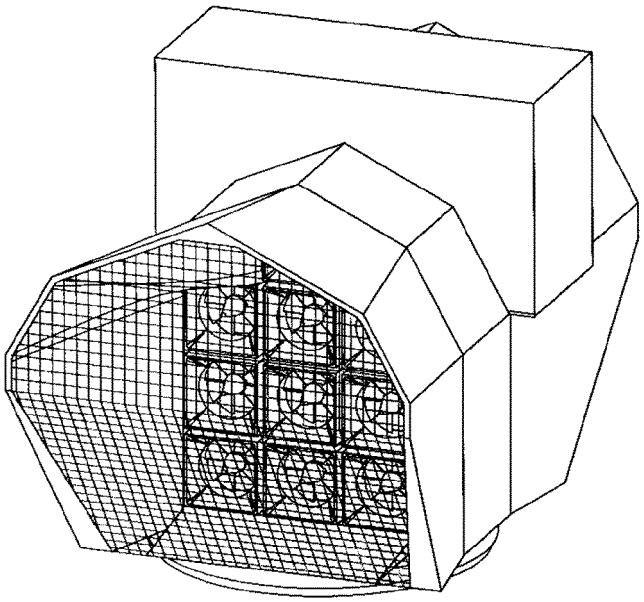

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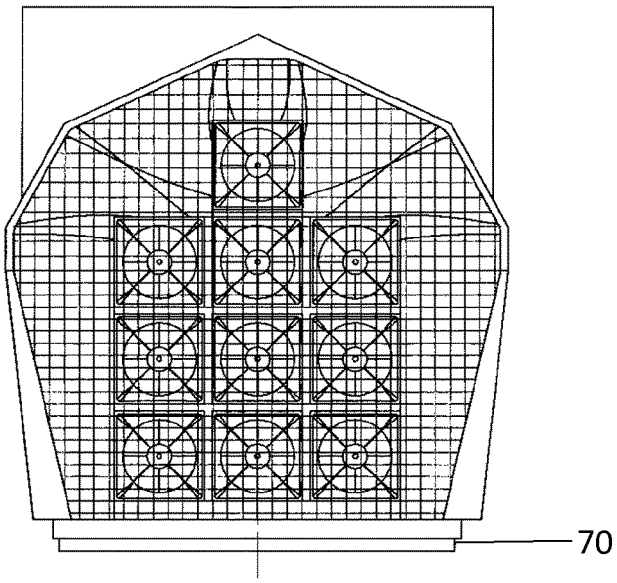

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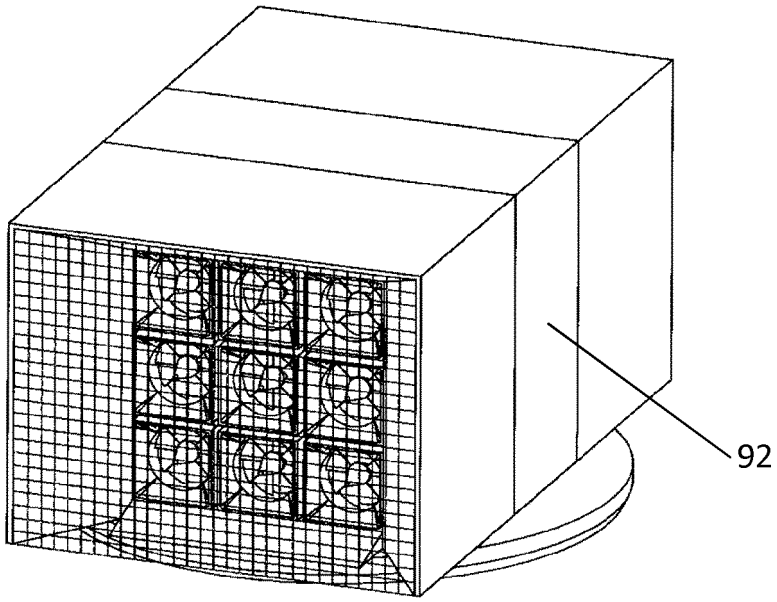

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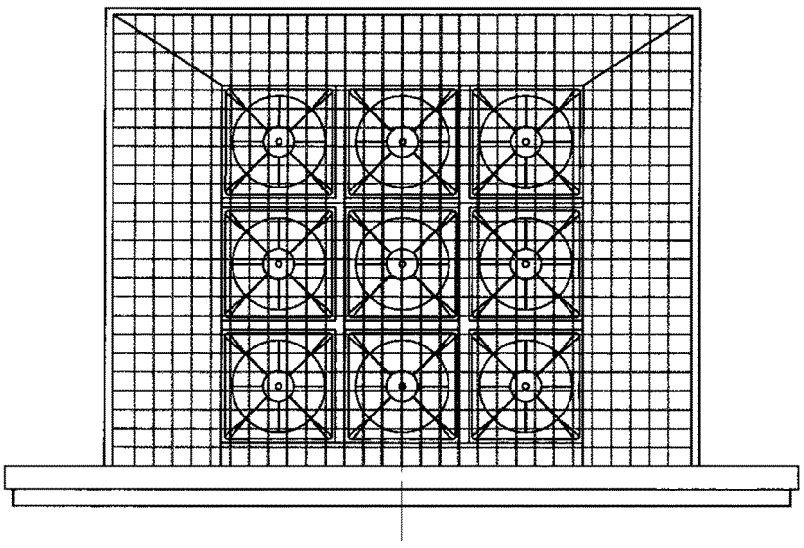

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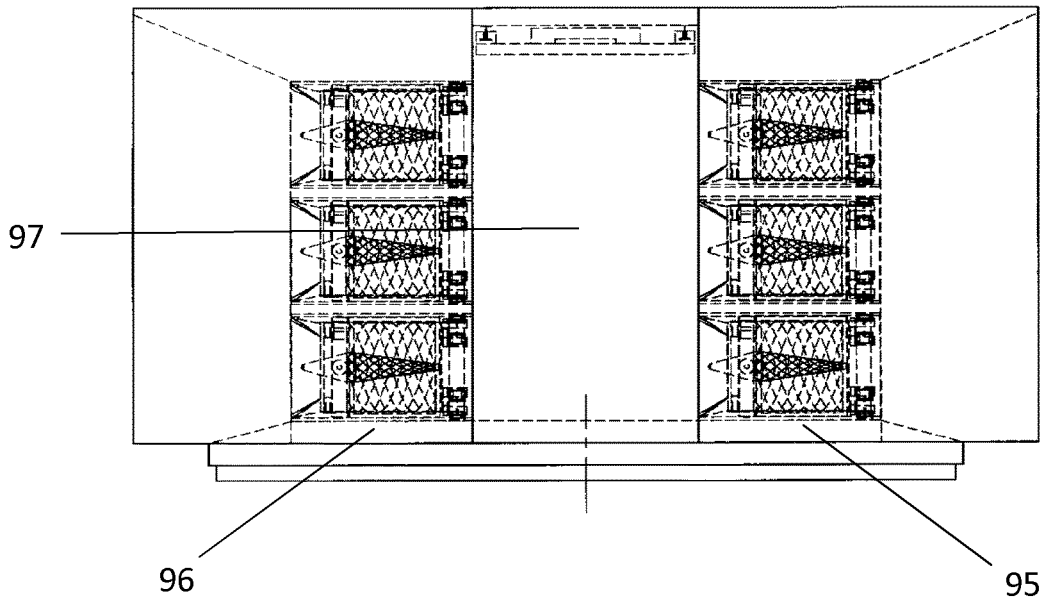

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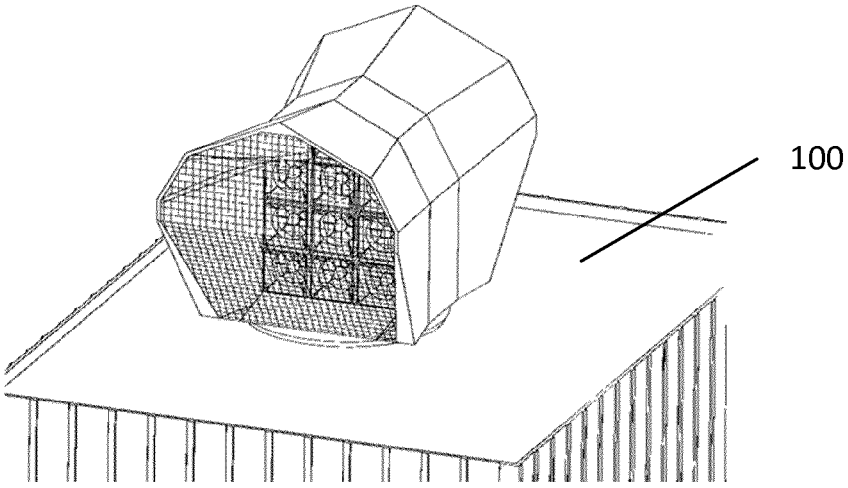

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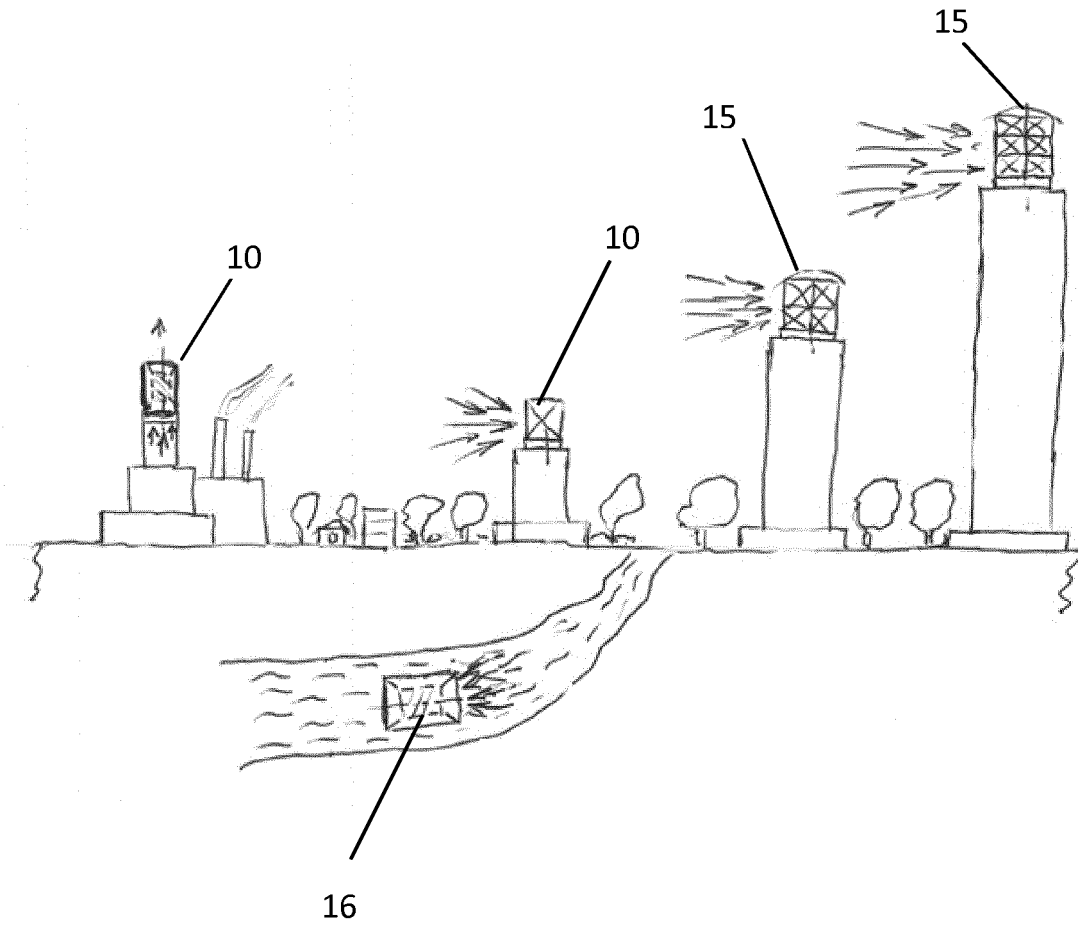

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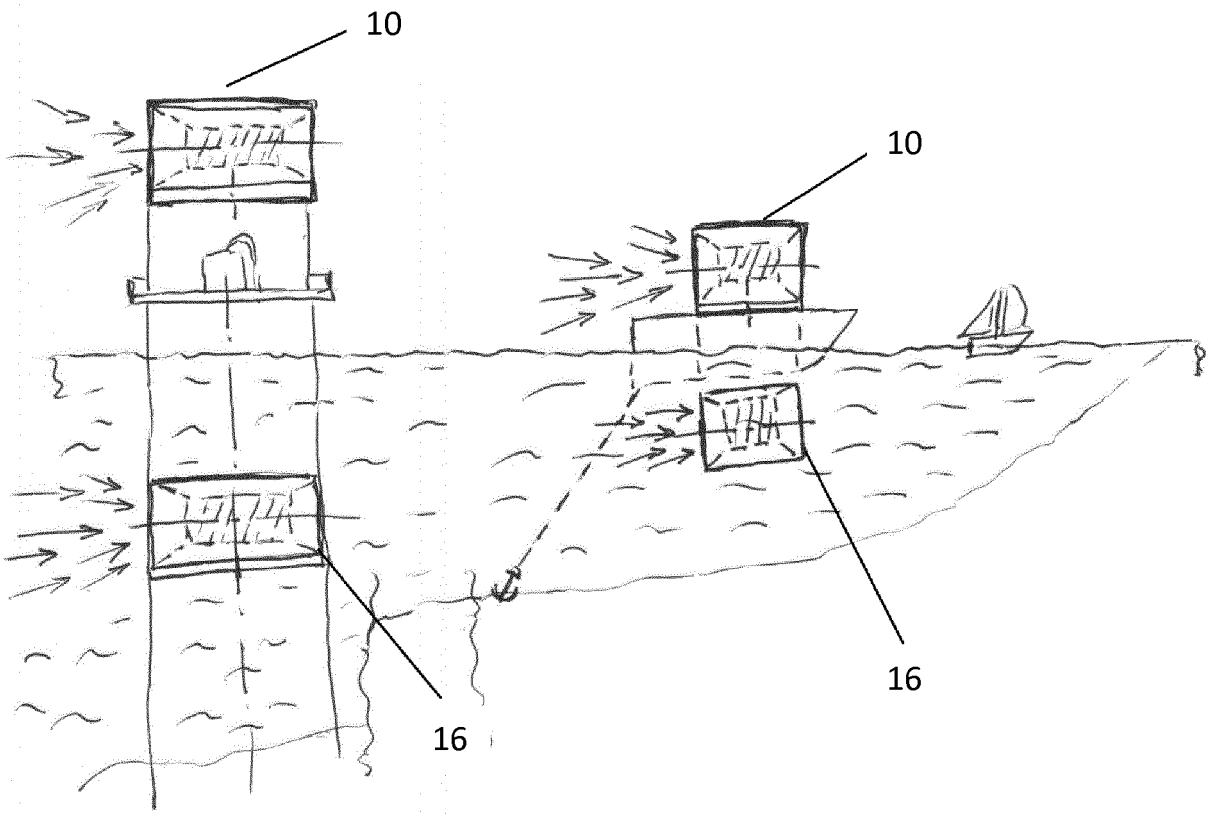
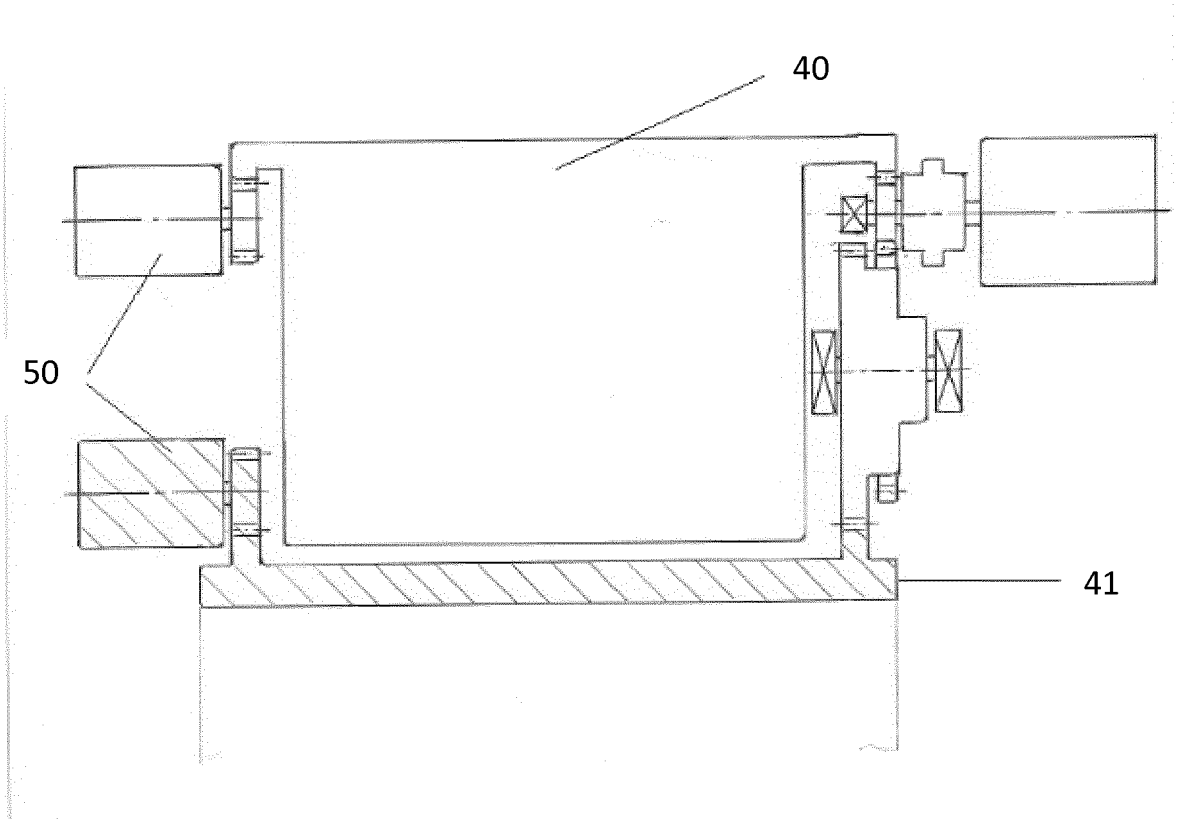


Figure 18



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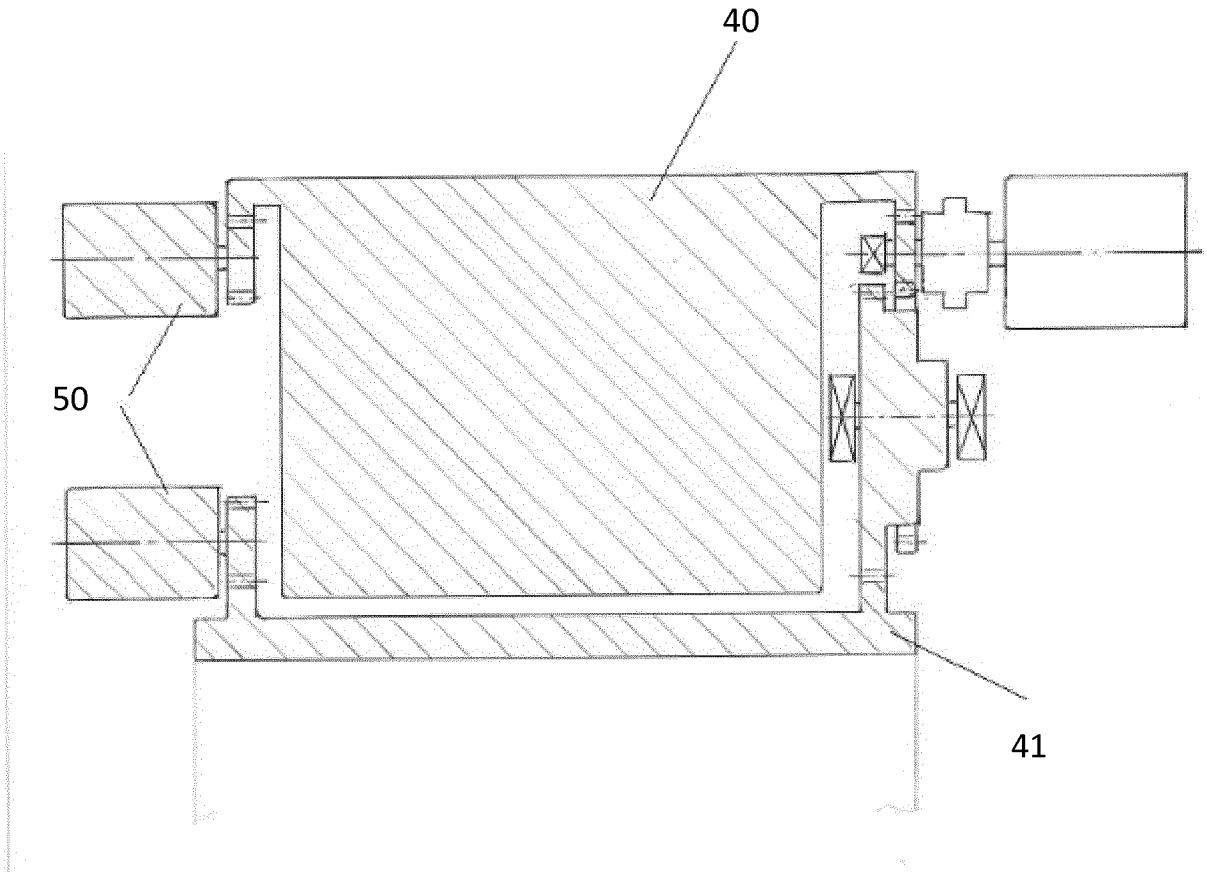

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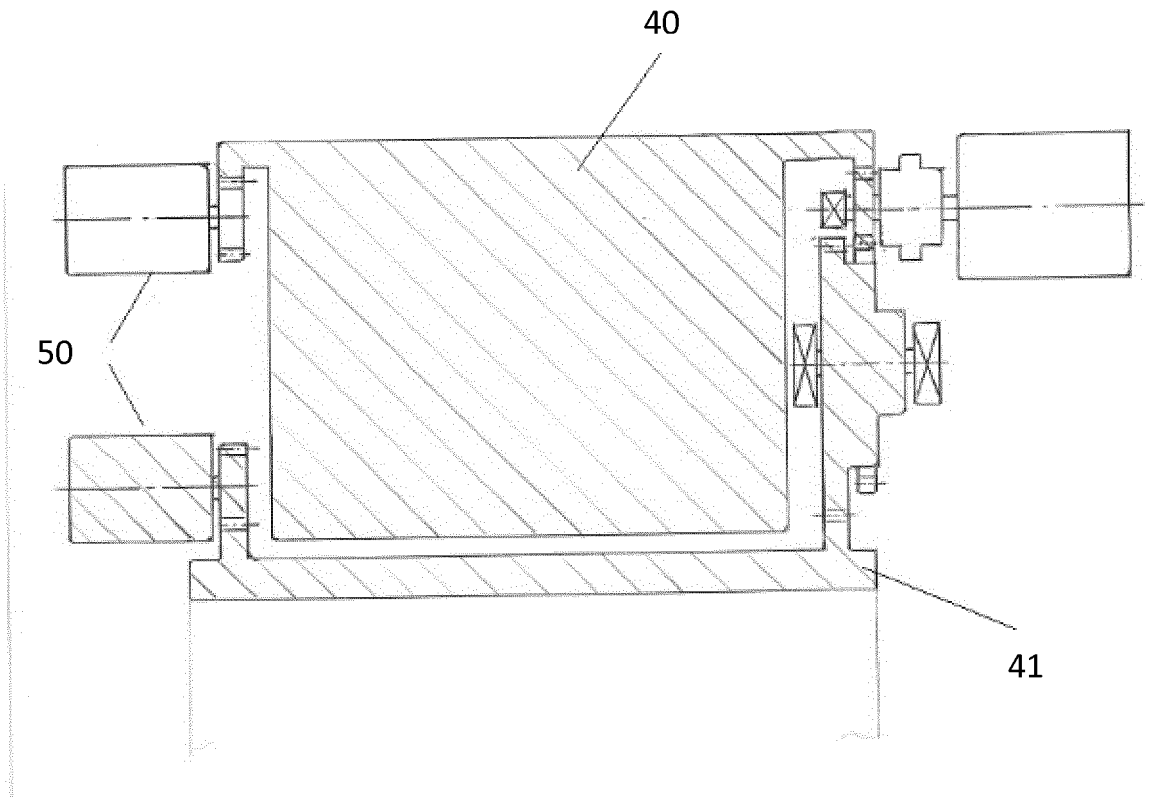

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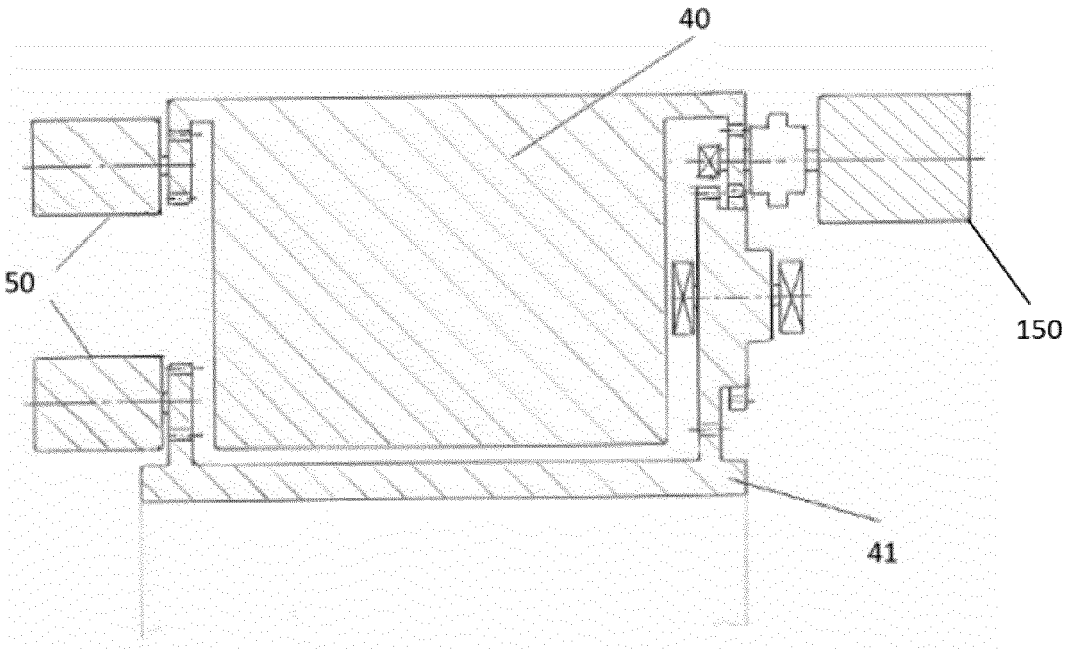

Figure 22

REFERENCES CITED IN THE DESCRIPTION

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